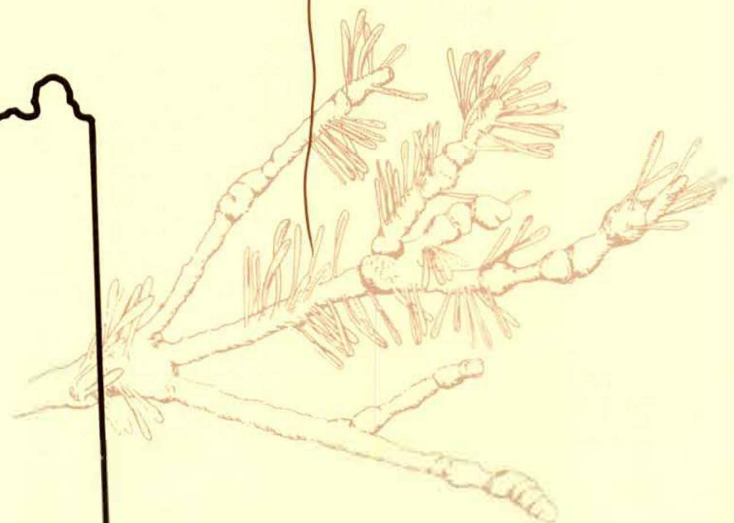
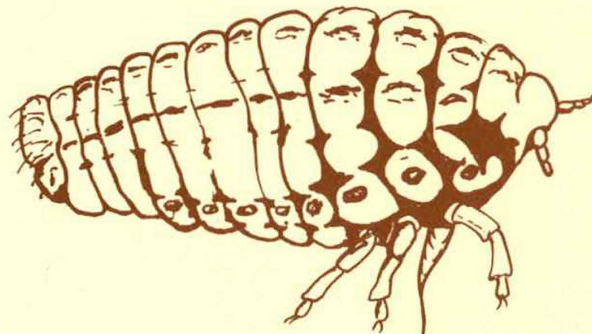
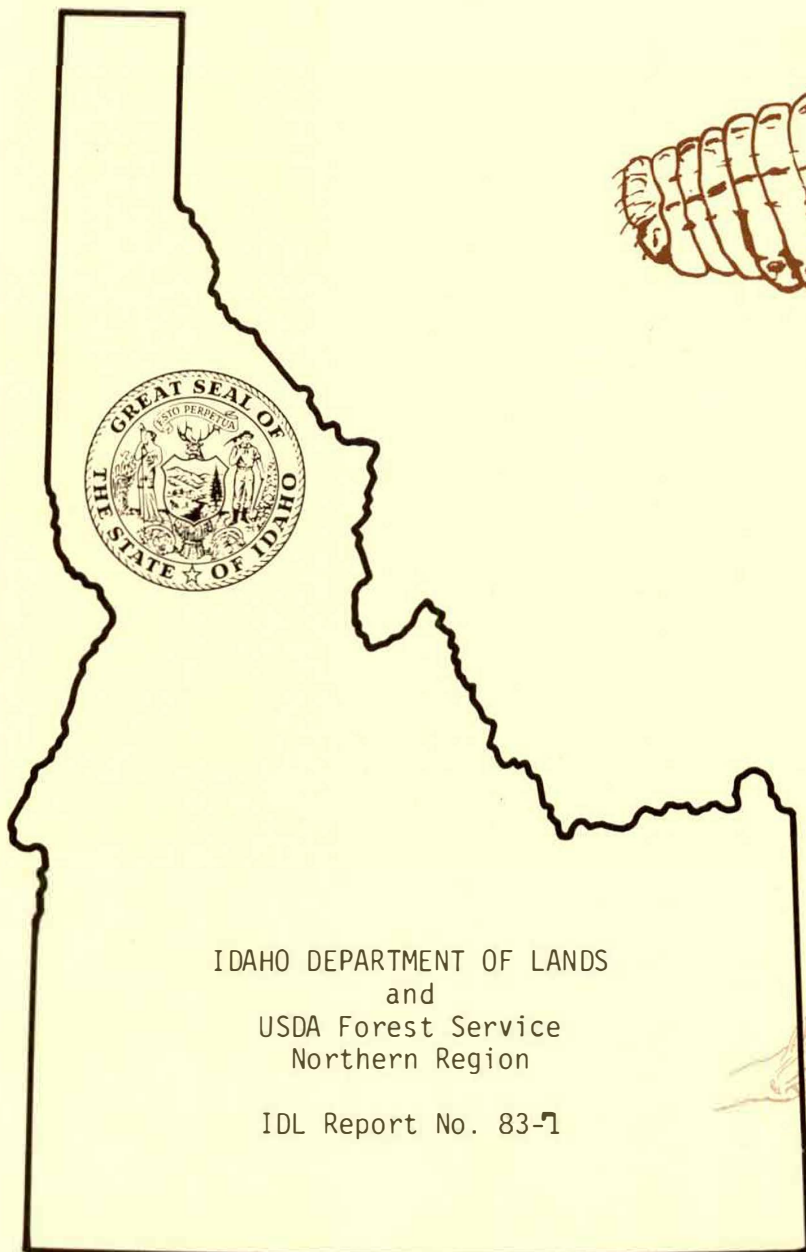


BALSAM WOOLLY APHID

Report of an **IDAHO** Infestation



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REPORT OF AN IDAHO INFESTATION

by

R. Ladd Livingston
Supervisor, Insect and Disease Section
Idaho Department of Lands
Coeur d'Alene, Idaho 83814

and

Jerald Dewey
Supervisory Entomologist
Cooperative Forestry and Forest Pest Management
USDA Forest Service, Northern Region
Missoula, Montana 59807

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R. Ladd Livingston¹
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ABSTRACT

The balsam woolly aphid has recently been found in several locations in northern Idaho, specifically in Coeur d'Alene and at five locations east of Moscow. Since this insect has caused extensive damage to Pacific silver fir and to a lesser degree to subalpine fir and grand fir in portions of western Washington, Oregon and British Columbia, it is important to monitor its spread in Idaho. The insect is mainly dispersed by blowing on air currents but can also be spread by birds, animals, people and vehicles. It has the potential to spread throughout the susceptible host type of our area. True firs are the only known hosts of the woolly aphid. Subalpine fir is most susceptible and grand fir is the least susceptible of the hosts in the western states. Symptoms of attack are the white waxy covering of the insects, which is normally seen on the trunk, gouting of branches and leaders, and tree decline and mortality. Foresters and other personnel visiting the forest should become familiar with the symptoms and report any observed infestation so that damage assessments can be made by trained entomologists.

INTRODUCTION

The balsam woolly aphid, *Adelges piceae* (Ratzeburg), is a European insect which was introduced into the northeastern United States and southeastern Canada about 1900. In the east it spread over extensive areas and killed or damaged thousands of acres of balsam fir (*Abies balsamea* (L.) Mill.)

¹Supervisor, Insect and Disease Section; Idaho Department of Lands; Coeur d'Alene, Idaho 83814.

²Supervisory Entomologist; Cooperative Forestry and Forest Pest Management; USDA Forest Service, Northern Region; Missoula, Montana 59807.

It was discovered in and near San Francisco, California, in 1928 infesting grand fir (*A. grandis* (Dougl.) Forbes), noble fir (*A. procera* Rehd.) and European silver fir (*A. alba* Miller) (Mitchell 1966). It was discovered in the Willamette Valley of western Oregon in 1930 where it was causing significant damage to grand fir (Keen 1952). In 1954 it was found killing Pacific silver fir (*A. amabilis* (Dougl.) Forbes) near Mount St. Helens in Washington and infesting subalpine fir (*A. lasiocarpa* (Hook) Nutt.) in both Oregon and Washington (Mitchell 1966). By 1957 an estimated 600,000 acres of forests in the two states were infested by the balsam woolly aphid and an estimated 1.5 billion fbm of mature Pacific silver fir had been killed or seriously weakened (Pope 1958).

In 1958 the insect was found on Pacific silver fir near Vancouver, British Columbia and on grand fir on Vancouver Island (Silver 1959). In 1961 it was found east of the Cascade range near Goldendale, Washington, at Simcoe Ridge on the southern boundary of the Yakima Indian Reservation (R. Mitchell, personal communication). In March of 1974 it was found in the Tiger Creek drainage of the Blue Mountains of eastern Oregon, 18 air miles east of Milton-Freewater, just south of the Oregon-Washington border (T. Gregg and R. Mitchell, personal communication). A count of deformed tree rings showed that the insect had been present for at least seven years. In the spring of 1978 it was found in the Tolgate area of the Blue Mountains of eastern Oregon approximately 18 air miles southeast of Milton-Freewater (L. Kline, personal communication).

Serious aphid-caused damage has not resulted from the infestations in eastern Oregon or Washington. Communication with personnel of the Oregon Department of Forestry; the USDA Forest Service Forest Pest Management of Region 6, Portland, Oregon; and the Canadian Forestry Service, Vancouver, B. C.; indicates that the balsam woolly aphid is not currently a problem anywhere in Oregon, Washington or British Columbia.

IDAHO INFESTATION

In February of 1983 the balsam woolly aphid was found on ornamental subalpine fir in Coeur d'Alene, Idaho. In August 1983 it was found at five separate locations in northern Idaho, all east of Moscow. These locations are:

1. At the Little Boulder Campground, two miles south of Helmer.
2. On Idaho Highway 8, approximately two miles south of Bovill.
3. Idaho Highway 8 at Cameron Creek, approximately four miles west of Elk River.
4. East of Elk River two miles up Partridge Creek.
5. On the road between Long Meadow and Round Meadows approximately seven miles south and two miles east of Bovill.

At each of these five locations (Fig. 1) the principal host is subalpine fir with grand fir also being infested to a much lesser degree. At the Little Boulder Campground several polesize subalpine fir have been killed by the balsam woolly aphid.

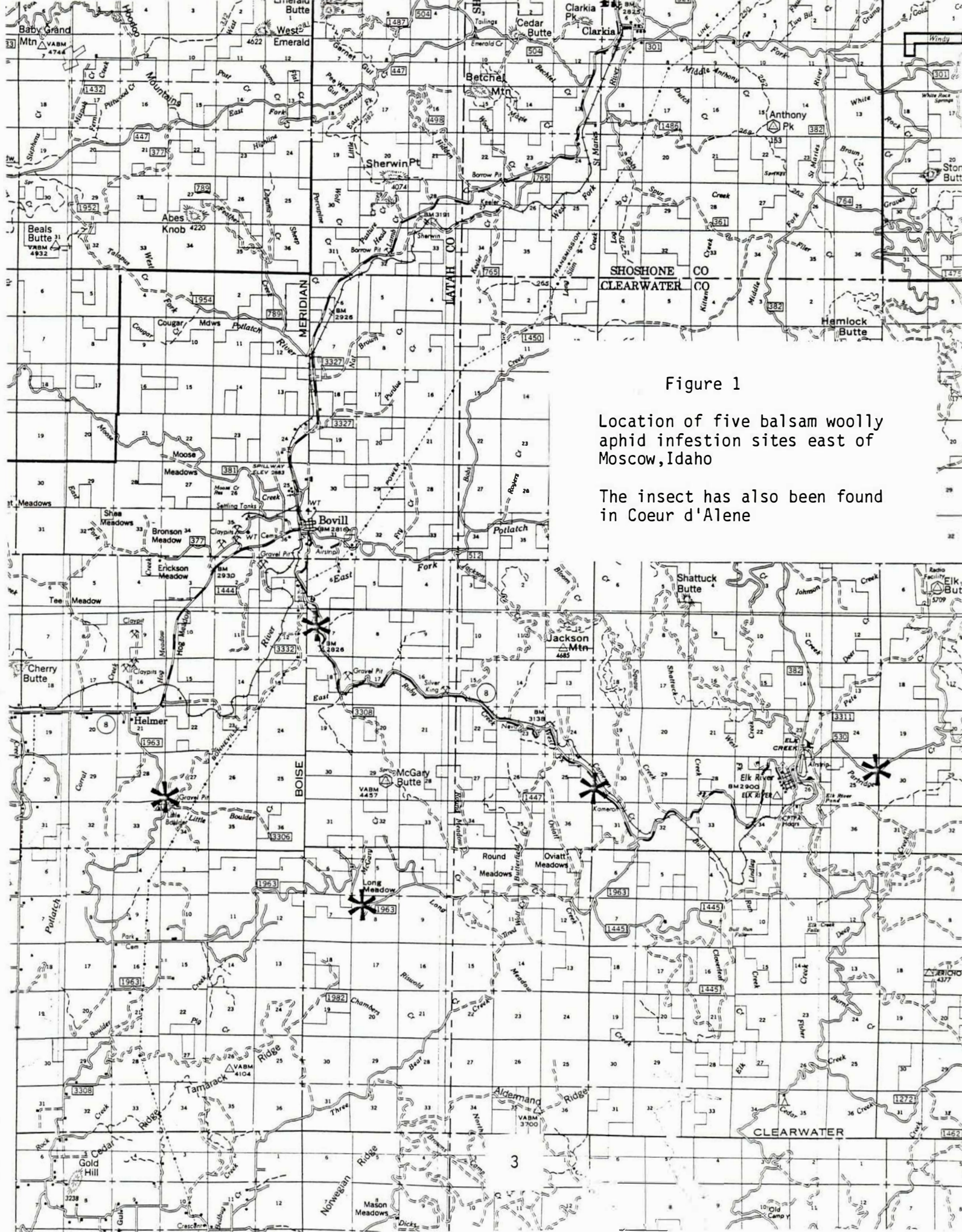


Figure 1

Location of five balsam woolly aphid infestation sites east of Moscow, Idaho

The insect has also been found in Coeur d'Alene

Damage characteristics on infested trees in Coeur d'Alene and at Little Boulder Campground reveal the insect has been present at these locations for at least five years.

Because of the potential for damage to the true firs of the Northern Rocky Mountain Region we need to monitor this infestation and determine its rate of spread and measure the damage it might cause.

GENERAL INFORMATION

The Insect: The balsam woolly aphid belongs to the family Phylloxeridae (Chermidae, Adelgidae), which includes insects such as the cooley spruce gall aphid and the pine bark aphid. It is a tiny sucking insect that gets its nourishment by inserting its long mouth parts into living bark of the main stem and branches. The adult is small (about 1 mm. long), dark purple to black, nearly spherical and wingless. In North America balsam woolly aphid populations are composed wholly of females. Reproduction therefore is parthenogenetic, i.e., without mating and fertilization; hence, it takes only one individual to form a new colony. The adult insect produces a thick waxy, white mass of wool-like material which completely covers and protects the insect (Fig. 2). This white mass is all that is normally seen (Figs. 2, 4 and 5). Eggs are laid under this protective cover.



Figure 2.

White wool-like masses of wax that cover each adult aphid.

In the western states the newly hatched crawler (Fig. 3-2), or first instar, is the only life stage capable of directed movement. It disperses and selects a feeding site, most often in bark lenticels or other roughened areas of the main stem, around branch and twig nodes, and at the base of buds in the crown. Once located the crawler inserts its mouth parts into the bark, and transforms into a non-motile form, with a characteristic pattern of white wax exudations over the body (Fig. 3-3). This is the overwintering form. Feeding begins after several weeks, or after overwintering. After three moults, it develops to the mature female insect which begins laying eggs (J. W. E. Harris 1978).

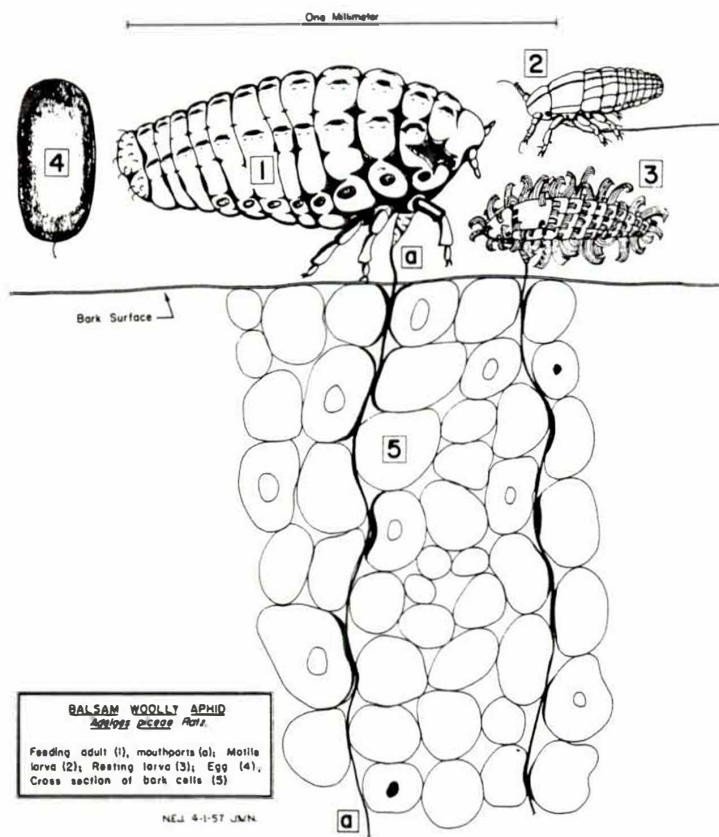


Figure 3.

Balsam woolly aphid life stages. Waxy "wool" covering omitted from drawing of feeding adult.

The balsam woolly aphid has tremendous reproductive potential with two to four generations per year, depending on locality and elevation, and epidemics seemingly occur overnight. Dispersion is thought to be mainly by wind currents, although birds, animals, people and vehicles are also suspected as contributing to movement of the insect.

Hosts: True firs are the only known hosts of the woolly aphid. Few, if any, are resistant to infestations. North American species seem to be most sensitive to attack. In the Pacific Northwest subalpine fir, Pacific silver

fir, and grand fir are the most common hosts. Of these three, subalpine fir is the most susceptible and grand fir is the most resistant (Mitchell 1966) with relatively little mortality being documented due to the balsam woolly aphid on this host. Other species planted as ornamental exotics have also been attacked. All sizes of tree are attacked, although polesize and larger seem most susceptible.

Symptoms of Attack: When the adults are present, the most obvious symptom is the white woolly covering of the aphids themselves (Figs. 2, 4 and 5) which is usually seen on the tree trunk.



Figure 4. Light infestation of balsam woolly aphid on subalpine fir.



Figure 5. Moderate-heavy infestation of balsam woolly aphid on subalpine fir.

Swellings of the outer branch nodes and terminal buds (called "gouting") with a concurrent stunting of growth is a symptom found on all North American firs (Figs. 6 and 7).



Figure 6.

Severe gouting of a subalpine fir branch. Each "bump" represents one year's growth.

Figure 7.

Gouting of a grand fir leader. Note the swellings and the greatly reduced growth.



As the infestation continues the trees show various degrees of decline ranging from branch killing (Fig. 8) to complete tree mortality. As a tree dies the foliage begins to fade going from green to yellow to deep red or brown in subalpine fir and from green to grayish green in grand fir.

Figure 8.

Complete branch mortality due to balsam woolly aphid feeding. Note the white appearance of the trunk due to a heavy infestation.



Effect on Host Trees: The injury results in a localized reaction by the tree in response to chemicals injected into the bark by the aphid as it feeds. This material affects the hormonal action of the tree and causes abnormal differentiation and cell division in the bark and newly formed wood resulting in the swellings on the branches. On the bole, the annual rings are abnormally wide and reddish in color. The wood is similar to compression wood and is hard and very brittle.

The overall decline in vigor of attacked trees results from inhibition of the buds and the subsequent loss of photosynthetic surface. Trees with attacks mainly on the branches decline slowly, sometimes persisting for years. Growth is retarded and the dead and dying upper stem is often invaded by wood-destroying fungi. This is the condition most often seen in grand fir. Obstruction of water and food conducting tissues is a principal problem associated with stem infestations. Stem attacked trees often die quickly, sometimes after only two to three years of infestation. Gouting is seldom conspicuous on this type of tree. This condition is often found on subalpine fir.

Limiting Factors: The host tree itself is normally the main limiting factor for woolly aphid populations. On stem attacked trees that survive more than two years, patches of dead or impenetrable (to the insect) bark may be formed. The population then is restricted to smaller and smaller areas until most aphids die. As the tree continues to grow, however, the protective layer cracks and the tree can be subject to reinfestation after several years.

In northern Washington and Oregon the most severe outbreaks occurred at the lower end of the host species' elevation range, i.e., from 3,000-5,500 feet in subalpine fir and below 1,000 feet in grand fir (Mitchell 1966). This elevational restriction may exist in the interior also, providing an additional limiting factor to the success of this insect in Idaho. To date, except for the Coeur d'Alene area, all of the known Idaho infestation sites have been found in low elevation frost pockets where subalpine fir is growing in isolated pockets.

RECOMMENDATION

Due to the potential for damage to the true firs of the Northern Rocky Mountain Region by the balsam woolly aphid we need to monitor this infestation to determine its rate of spread and measure the damage it might cause. We request the assistance of foresters and forest visitors to watch for infestation of this insect and to report suspected sightings to the Idaho Department of Lands, Insect and Disease Section in Coeur d'Alene, Idaho; or to the USDA Forest Service, Cooperative Forestry and Pest Management, Missoula, Montana.

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